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M70/2 processing report

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1. Introduction

This report describes the processing of navigation, multibeam and sediment echosounding data from the RV "Meteor" expedition M70/2.

The main objectives of this order were the processing of the data, the copying of the data to the AWI's mass storage system and the referencing of the data sets in Pangaea including the creation of meta information tables.

2. Navigation data

2.1. *Original data*

The navigation data is an extract from the DSHIP data base on board of RV Meteor. The original data is held on magnetic tapes as a backup of the DSHIP database. The data set contains 66 data files, each with the navigation of one day in a time interval of one or ten seconds. The data volume of the 1-second-interval data is 168 MB, the data volume of the 10-second-interval data is 17 MB. The Raw data are:

- GPS positions from sensor CNAV-GPS
- GPS positions from sensor TRIMBLE-GPS
- Speed from sensor SYSTEM
- Heading from sensor Motion-Reference-Unit
- Depth from sensor MB-EM120

2.2. *Processing*

a) Processing steps:

1. Extraction of source data from DSHIP data base
2. Replace errors in CNAV-GPS data with TRIMBLE-GPS data
3. Automatic filtering of erroneous positions
4. Visual control of navigation data

b) Processed data:

Result of the processing is the verified navigation, held in ASCII table (tab delimited) with the following format:

- Column 1: Latitude [degree]
- Column 2: Longitude [degree]
- Column 3: Date [Format: DD.MM.YYYY HH:MM:SS]
- Column 4: Flag
- Column 5: Speed [knots]
- Column 6: Heading [degree]
- Column 7: Depth [metres]

The flag string consists of four digits with the following meaning:

- Digit 1:
 - [0]: No position available
 - [1]: Position based on sensor CNAV-GPS
 - [2]: Position based on sensor TRIMBLE-GPS
- Digit 2:
 - [0]: Position is not pitch corrected
 - [1]: Position is pitch corrected
- Digit 3:
 - [0]: Position is not roll corrected



[1]: Position is roll corrected

Digit 4:

[0]: Centering is based on heading from GPS data (less accurate)

[1]: Centering is based on heading from Motion-Reference-Unit

c) Statistic

Data volume 1-second-interval data: 168 MB

Data volume 10-second-interval data: 17 MB

First data: 22.10.2006 07:58:26

Last data: 23.11.2006 09:13:59

Total number of positions after processing:	2766773
Total number of CNAV-GPS data:	2749815 (99.39 percent)
Total number of TRIMBLE-GPS data:	16958 (0.61 percent)
Total number of invalid GPS data:	0 (0 percent)
Total number of positions without roll correction:	16958 (0.61 percent)
Total number of positions without pitch correction:	16958 (0.61 percent)
Total number of heading calculation from GPS data:	0 (0 percent)

2.3. Meta information

As decided by the AWI sections Geology and Data-centre the meta information table contains the following columns:

	Name	Sample	Format	Comment
1	Latitude [°N]	74.99766	f8.5	Latitude in decimal degrees
2	Longitude [°E]	2.29006	f8.5	Longitude in decimal degrees
3	Date/Time	22.10.2006 08:00:00	dd.mm.yyyy hh:mm:ss	UTC Date/Time
4	Speed	12.1	f5.1	Speed in knots
5	Course	123.1	f5.1	Course in decimal degrees
6	Depth	2496.8	f7.1	Depth in meter
7	Path (1-sec-interval)	http://hs.pangaea.de/nav/m70/ m70_1022_01sec.nav	char[80]	Path to navigation data files in 1 second interval (ASCII table)
8	Path (10-sec-interval)	http://hs.pangaea.de/nav/m70/ m70_1022_10sec.nav	char[80]	Path to navigation data files in 10 second interval (ASCII table)

2.4. Pangaea referencing

All data sets (ASCII tables) are stored in the AWI mass storage system on task.awi-bremerhaven.de available from <http://hs.pangaea.de/nav/m70>. The data sets can be downloaded using the meta information table published on www.pangaea.de. Enter "M70/2 Navigation" in the accordant search box in 'PangaVista' to find the data. In the meta information file you can find links to the different data formats.

Please contact Dr. Hannes Grobe for restricting access to the data by password protection.

3. Multibeam data (EM120 and EM710)

3.1. Original data

The original data is held on hard drive on the data recording computer on board of RV Meteor. There are some changes of the file name of the original raw data file: the prefacing line number (four digits) was deleted, the sensor name (EM120 or EM710) was added. The data were recorded using the Kongsberg SIS software, the time period of each raw data file is 30 minutes. Data from the following sensors are included in the multibeam raw data:

Bathymetry data: Kongsberg EM120/EM710



Position data: CNAV-DGPS
Heading: Motion-Reference-Unit
Heave/Pitch/Roll: Motion-Reference-Unit
Sound velocity water column: sound velocity profiler
Sound velocity transducer: sound velocity probe

The data set contains 796 raw files of the sonar system EM120 (8.9 GB) and 37 raw files of the sonar system EM710 (239 MB). Compressing the data reduces the data volume approx. to half of the size. Several data gaps are caused by echosounder shutdowns during AUV (autonomous underwater vehicle) dives.

3.2. Processing

These are raw data, no data cleaning or data processing was done.

3.3. Data visualization

The GMT (Generic Mapping Tool) program version 4.1.4 was used to automatically create maps of the multibeam data. To export ASCII data (position and depth) out of the raw multibeam data the program MB-System Version 5.1.0 was used. Because the time period of each raw data file is only 30 minutes, the multibeam data were arranged to sets of 8 hours time interval before creating the maps. For every day of multibeam data acquisition three maps were created, from 0 hours to 8 hours, from 8 hours to 16 hours and from 16 hours to 24 hours. For naming the maps the time interval of the plotted data was used in the following format: "jday"- "beginning-hour"- "ending-hour"_EMxxx.png, i. e. 305-00-08_EM120.png. The format of the maps is the PNG (Portable Network Graphic) format, see one example below.

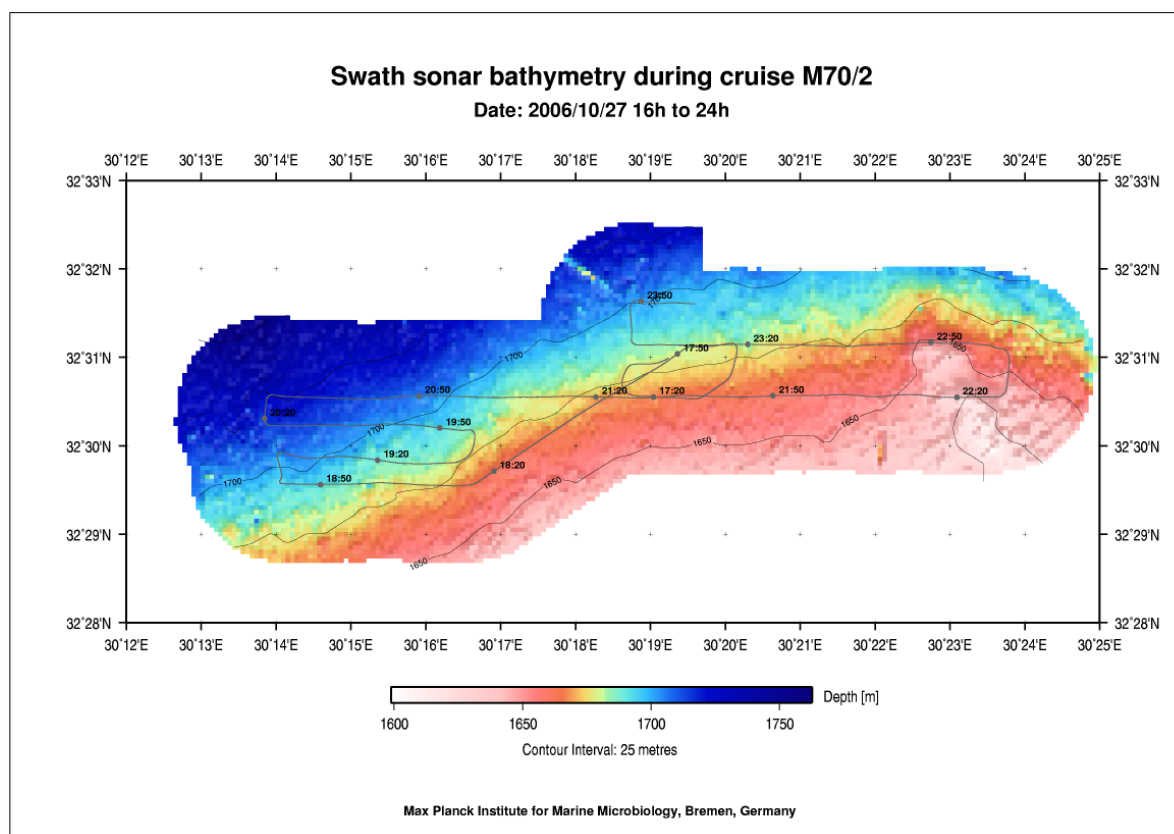


Figure 1: Example of a map of 8 hours multibeam data (EM120).



3.4. Meta information

As decided by the AWI sections Geology and Data-centre the meta information table contains the following columns:

	Name	Sample	Format	Comment
1	Latitude [°N]	74.99766	f8.5	Latitude in decimal degrees
2	Longitude [°E]	2.29006	f8.5	Longitude in decimal degrees
3	Date/Time	22.10.2006 08:00:00	dd.mm.yyyy hh:mm:ss	UTC Date/Time
4	Path (raw file)	http://hs.pangaea.de/bathy/m70/20061022_175748_Meteor_EM710.all.gz	char[80]	Path to compressed raw data file (sonar specific binary, little endian)
5	Path (meta file)	http://hs.pangaea.de/bathy/m70/20061022_175748_Meteor_EM710.xml	char[80]	Path to meta file (FGDC standard, xml format)
6	Path (graphic file)	http://hs.pangaea.de/bathy/m70/295-16-24_EM710.png	char[80]	Path to graphic file with bathymetry map (A4) of 8 hours (PNG format)

In addition to the meta information table, describing the multibeam data of the entire cruise, there is one meta file for each raw file, giving specific information about every raw file, i. e. geographic limits, amount of data or system parameters of the survey. The format of the meta file is based on the FGDC Content Standard for Digital Geospatial Metadata with some extensions for bathymetry raw data, implemented in XML (Extensible Markup Language). A description of the metadata standard extension can be found at:

[http://www.pangaea.de/documentation/Bathymetry/Extension Bathymetry RawData.pdf](http://www.pangaea.de/documentation/Bathymetry/Extension_Bathymetry_RawData.pdf).

3.5. Pangaea referencing

All data sets (raw files, meta files and graphic files) are stored in the AWI mass storage system on task.awi-bremerhaven.de available from <http://hs.pangaea.de/bathy/m70>. The data sets can be downloaded using the meta information table published on www.pangaea.de. Enter "M70/2 Bathymetry" in the accordant search box in 'PangaVista' to find the data. In the meta information file you can find links to the different data formats.

Please contact Dr. Hannes Grobe for restricting access to the data by password protection.



4. Sediment echosounding data (Parasound)

4.1. Original data

The original Parasound data (ps3-files) were held on one LTO tape. Only the SLF (secondary low frequency) data set was used for processing. The data set contains a number of 151 ps3-files with a data volume of 510 MB.

4.2. Navigation data

The file headers of Parasound ps3-files contain the original navigation recorded at expedition time. No further processing was made.

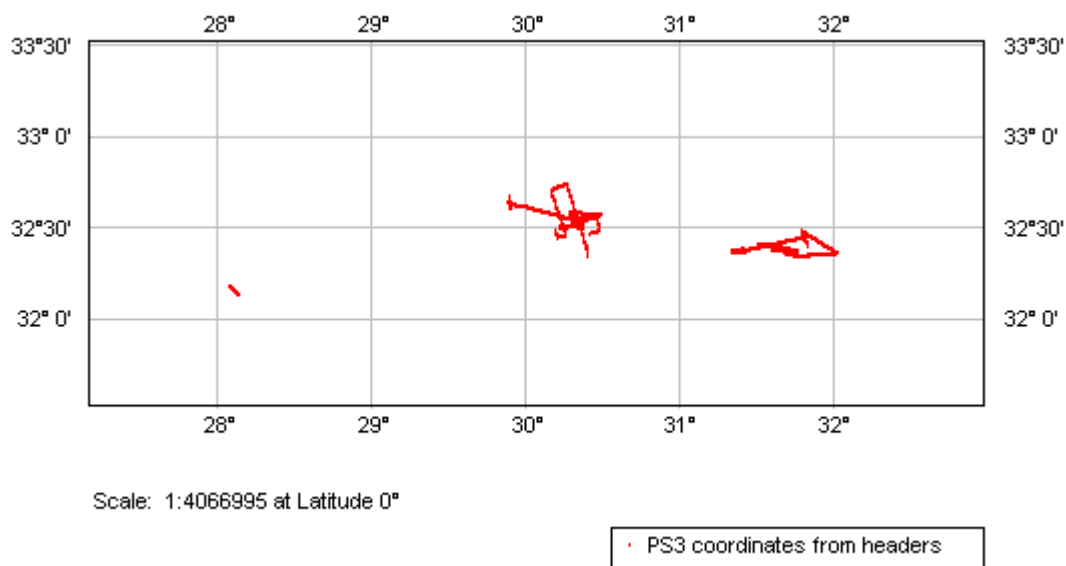


Figure 2: The Parasound ps3-file header navigation of M70/2 expedition data.

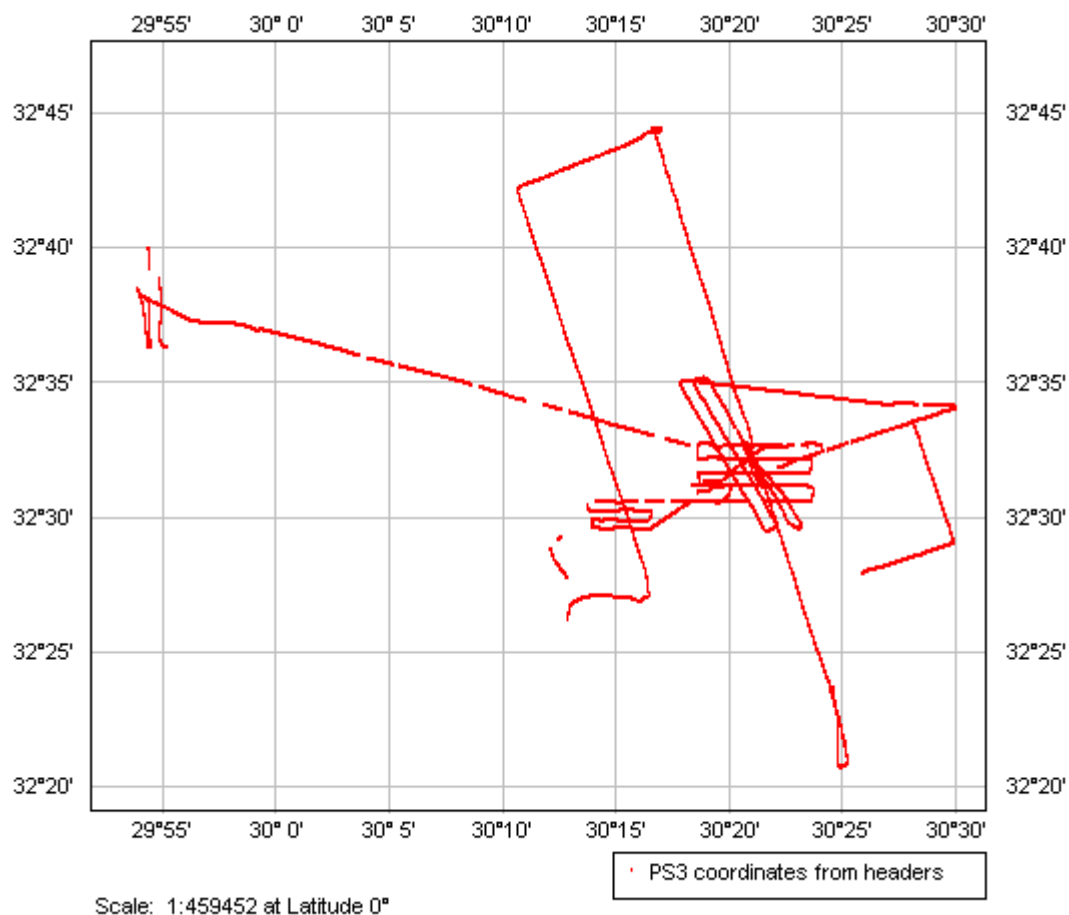


Figure 3: Enlarged view of the Parasound ps3-file header navigation of leg M70/2a.

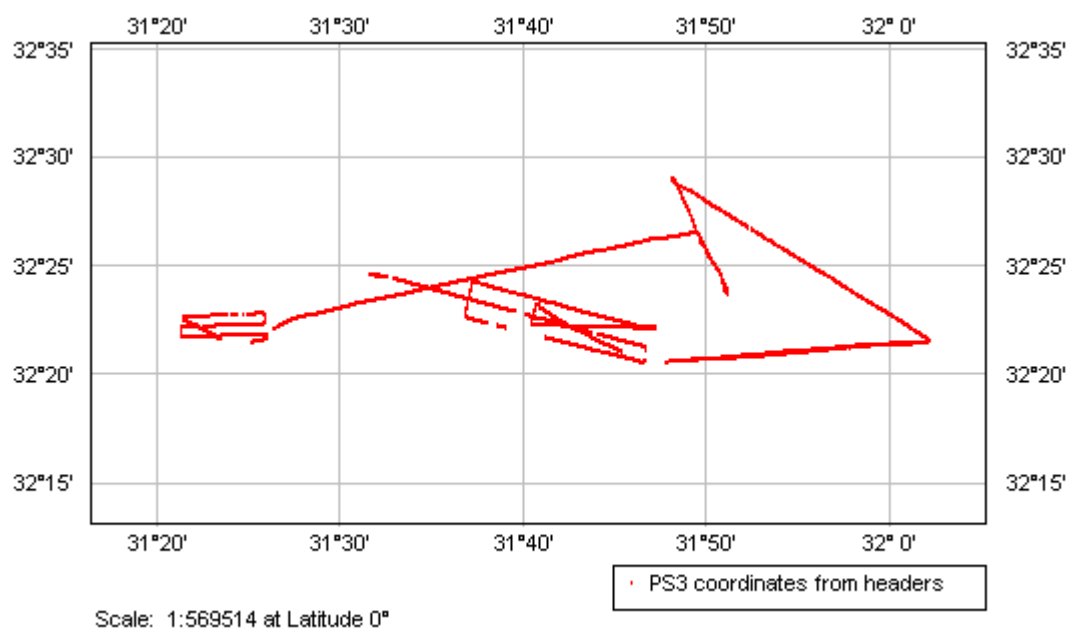


Figure 4: Enlarged view of the Parasound ps3-file header navigation of leg M70/2b.



4.3. Processing

The ps3-files were assigned to track profiles and sorted to accordant directories. The ps3-files are published as TAR archives of each profile directory. No further processing of the single ps3-files was made.

SEG-Y files were generated from the ps3-files for each track profile.

4.4. Data visualization with SeNT

The SeNT (Se suite for Windows NT) program (Universität Bremen, Hanno von Lom) was used to create plots of the Parasound data. The SeNT program executable version is 2.02 of 21/09/2005.

The Parasound data of each track profile was plotted by distance. These plots were saved as GIF image files. If a track profile is too long the plot is divided to several GIF files.

4.5. Meta information

As decided by the AWI sections Geology and Data-centre the meta information table contains the following columns:

Table 1: Description of the meta information table

	Name	Sample	Format	Comment
1	Latitude [°N]	74.99766	<i>f8.5</i>	Latitude in decimal degree
2	Longitude [°E]	2.29006	<i>f8.5</i>	Longitude in decimal degree
3	Date/Time	27.06.2001 00:00:00	<i>dd.mm.yyyy hh:mm:ss</i>	Date/time
4	Path (ps3)	http://hs.pangaea.de/para/m70/m70_06301307_s.ps3.tar	<i>char[80]</i>	Path to the ps3-files which are combined to TAR archives (you can extract them in Windows using Winzip)
5	Path (sgy)	http://hs.pangaea.de/para/m70/m70_06301307_s.sgy	<i>char[80]</i>	Path to SEG-Y files
6	Path (image)	http://hs.pangaea.de/para/m70/m70_06301307_s_01.gif	<i>char[80]</i>	Path to the data plots (GIF-files). These may be separated in several files for longer track profiles
7	Last file	06301438.ps3	<i>mmddhhmm.ps3</i>	Last ps3-file of a track profile

4.6. Pangaea referencing

All data sets (ps3-tar-archives, sgy-files and gif-files) are stored in the AWI mass storage system on task.awi-bremerhaven.de available from <http://hs.pangaea.de/para/m70>. The data sets can be downloaded using the meta information table published on www.pangaea.de. Enter "M70/2 Parasound" in the accordant search box in 'PangaVista' to find the data. In the meta information file you can find links to the different data formats.

Please contact Dr. Hannes Grobe for restricting access to the data by password protection.